

EPA Climate and Waste Program

U.S. Environmental Protection Agency
Office of Solid Waste





Presentation Overview

■ Introduction

- What is climate change?
- Environmental impacts of climate change
- Waste sector emissions
- Linkages between waste management practices and GHG emission reductions

■ Climate and Waste Program

- Research and technical assistance
- Program implementation
- Education and outreach

■ Summary



What is Climate Change?

- “A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.” *United Nations Framework Convention on Climate Change*



Environmental Impacts of Climate Change

- Health Impacts
- Agriculture Impacts
- Forest Impacts
- Water Resource Impacts
- Impacts on Coastal Areas

For more information:

<http://www.epa.gov/globalwarming/impacts/index.html>



Waste Sector Emissions

■ Landfills

- Methane is produced, but can be flared or recovered for energy
- Some of the carbon in materials that are landfilled is stored long term

■ Combustion

- Carbon dioxide and nitrous oxide are emitted

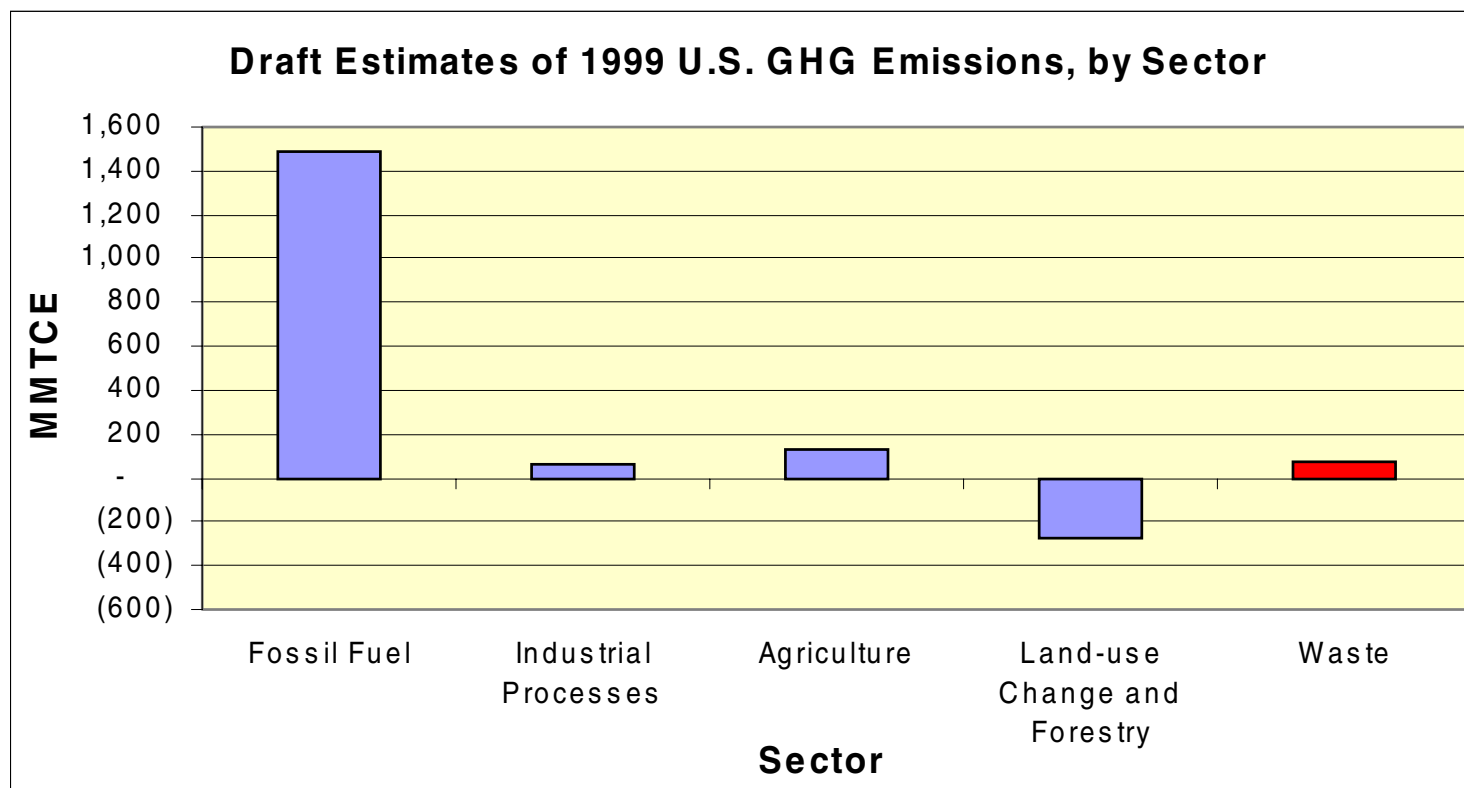
■ Wastewater Treatment

- Methane and nitrous oxide are emitted



Waste Sector Emissions (cont.)

1999 Emissions by Sector



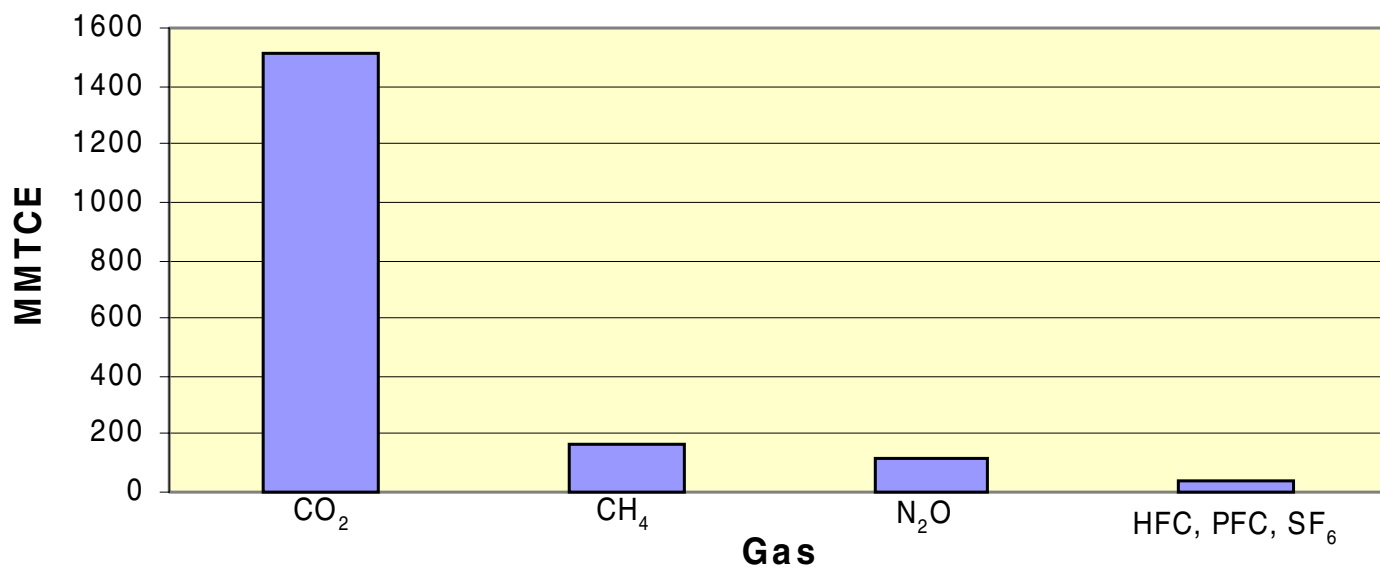
- In 1999, the waste sector accounted for nearly 5% of net GHG emissions.



Waste Sector Emissions (cont.)

1999 Emissions by Gas

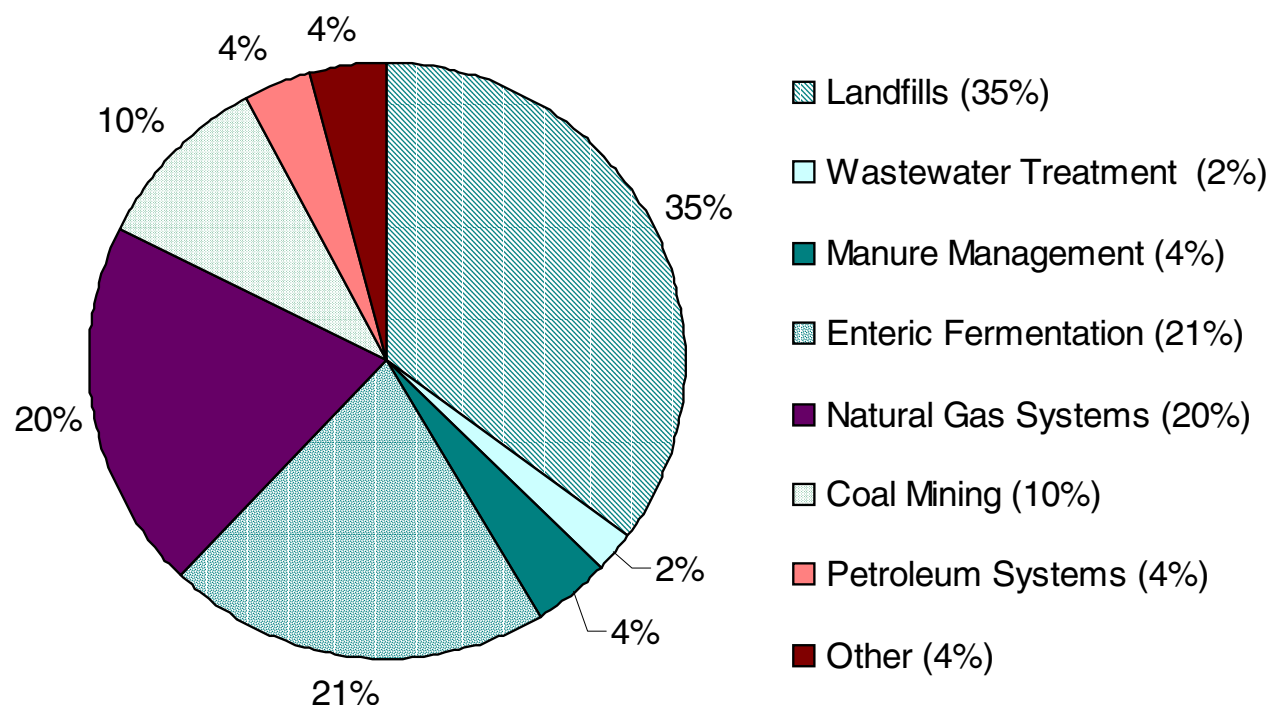
Draft Estimates of 1999 U.S. GHG Emissions, by Gas





Waste Sector Emissions (cont.)

1999 CH₄ Emissions by Source



**Other includes: Rice Cultivation, Stationary Combustion, Mobile Combustion, Petrochemical Production, and Agricultural Residue Burning.*

■ Landfills are the largest anthropogenic source of CH₄ emissions in the US, accounting for 35 percent of total CH₄ emissions.



Linkages: Waste Management and GHG Reductions

■ “Upstream” links

- Energy CO₂ emissions avoided through source reduction & recycling
- Forest carbon storage increases when wood products are source reduced & recycled
- Carbon storage increases when organics are composted and added to soil

■ “Downstream” links

- Landfill CH₄ emissions avoided through source reduction & recycling
- Combustion CO₂ emissions avoided through source reduction & recycling



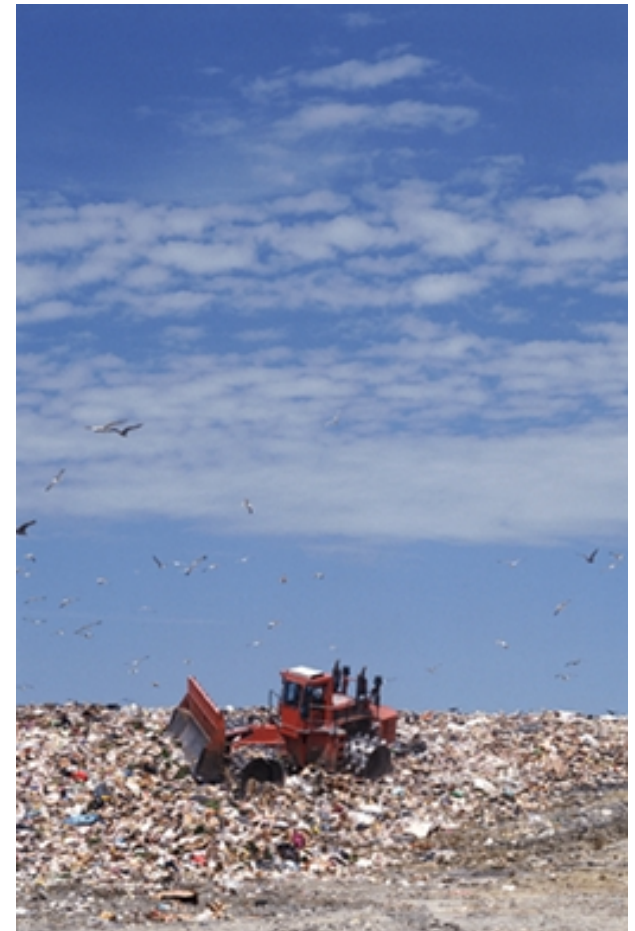
Linkages: Waste Management and GHG Reductions (cont.)

- Waste is a small, but important, source
- Waste sector activities have great GHG emission-reduction potential
 - Climate and Waste Program activities have reduced cross-sectoral emissions
 - > 8 MMTCE (1994-1999 actions)
 - 3.2 MMTCE (1999 actions only)
 - Projected benefits of national recycling
 - 35% recycling in 2010 = 41 MMTCE
 - 50% recycling in 2020 = 57 MMTCE



Program Overview

- UNFCCC signed in 1992
- Climate Change Action Plan
 - Listed waste reduction as #16 out of roughly 50 U.S. initiatives to reduce GHG emissions
 - Program initiated in response
- Objective: identify and address linkages between waste reduction and climate protection and meet CCAP emission reduction target





Program Components

- Research and technical assistance
 - Conduct life-cycle analyses of waste management options and their impacts on GHG emissions; assist stakeholders
- National program implementation
 - Implement programs to reduce GHG impacts from the waste sector
- Outreach and education
 - Develop and distribute materials on climate change and waste management



Research and Technical Assistance **Purpose**

- Provide scientific basis for estimating GHG emission reduction benefits of waste management
- Target materials and management methods with large emission reduction potential
- Provide technical support to stakeholders

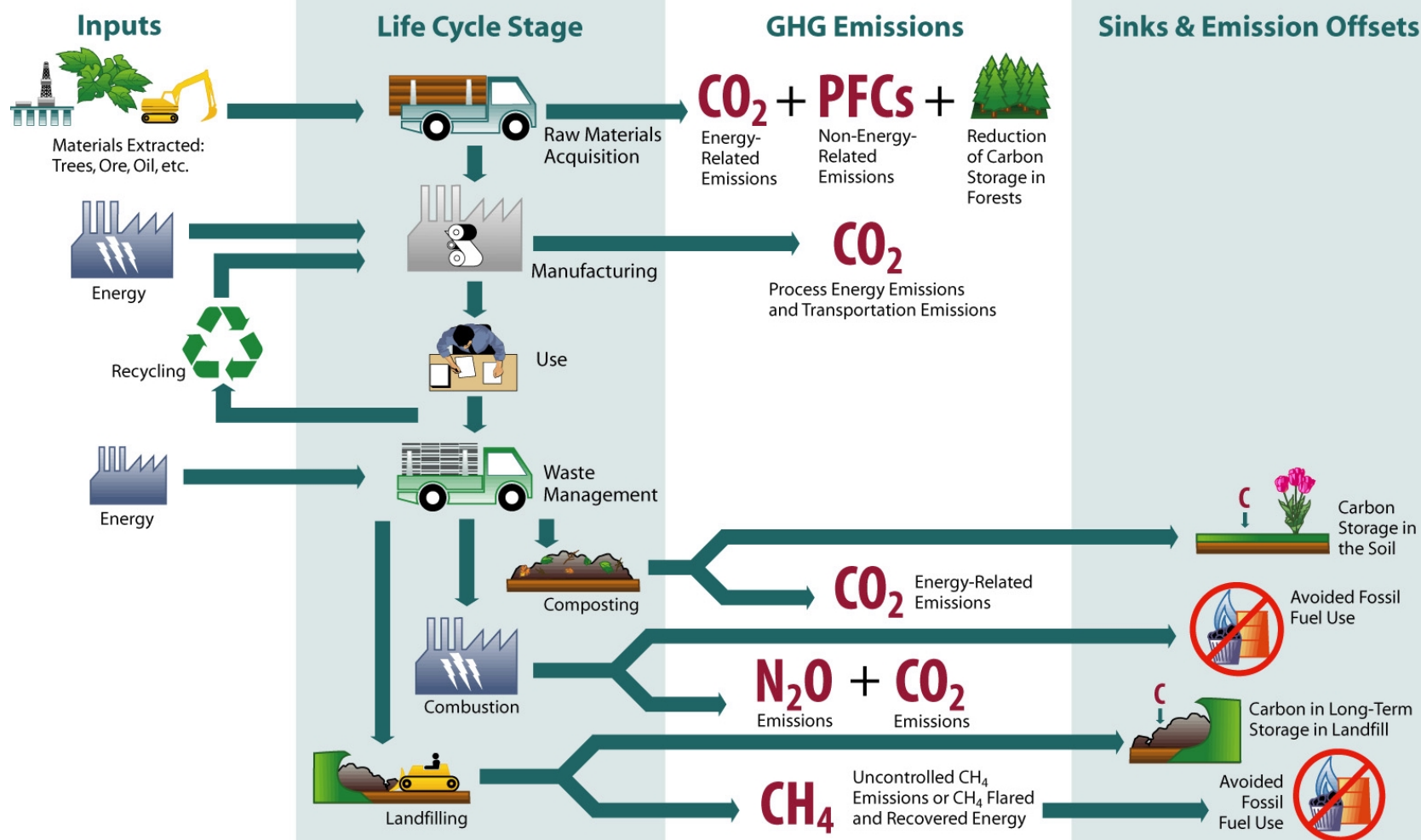


Research and Technical Assistance **Approach**

- Incorporate the full range of GHG effects through a material's life cycle
- Use IPCC accounting methods for GHG emissions and sinks
 - Global Warming Potentials (GWPs)
 - Carbon cycling in forests
 - CO₂ emissions from combustion



Research and Technical Assistance Life-Cycle Analysis of GHG Emissions





Research and Technical Assistance **GHG Emission Factors**

Sample Emissions Factors (MTCE/ton)

Material	Recycling	Landfilling
Newspaper	-0.86	-0.23
Office Paper	-0.82	0.53
Aluminum Cans	-3.88	0.01
Steel Cans	-0.57	0.01
HDPE	-0.37	0.01
Dimensional Lumber	-0.67	-0.12

- Sum of emissions and sinks throughout the material life cycle
- Expressed in units of metric tons of carbon equivalent per ton of material



Research and Technical Assistance **GHG Emission Factors (cont.)**

- Emission factors developed for:
 - 16 material types, mixed MSW, and mixed recyclables
 - Newspaper
 - Office Paper
 - Corrugated Cardboard
 - Mixed Paper - Broad Definition
 - Mixed Paper - Office Mix
 - Mixed Paper - Residential Mix
 - Glass
 - Aluminum
 - Steel
 - HDPE
 - LDPE
 - PET
 - Dimensional Lumber
 - Medium Density Fiberboard
 - Yard Trimmings
 - Food Scraps
 - Source reduction, recycling, composting, combustion, and landfilling



Research and Technical Assistance **GHG Emission Factors (cont.)**

■ Applications

- Program measurement methodology
- WASTE Reduction Model (WARM) spreadsheet tool



Research and Technical Assistance

Sample Calculation of Benefits

- GHG impact of recycling, rather than landfilling, 10 tons of office paper
 - Baseline: 10 tons x 0.53 MTCE/ton= 5.3 MTCE
 - Alternative: 10 tons x -0.82 MTCE/ton= -8.2 MTCE
 - Net change: -8.2 MTCE - (5.3 MTCE)= -13.5 MTCE





Research and Technical Assistance

Sample Calculation of Benefits

- GHG impact of recycling, rather than incinerating, 10 tons of office paper
 - Baseline: 10 tons x -0.19 MTCE/ton= -1.9 MTCE
 - Alternative: 10 tons x -0.82 MTCE/ton= -8.2 MTCE
 - Net change: -8.2 MTCE - (-1.9 MTCE)= -6.3 MTCE

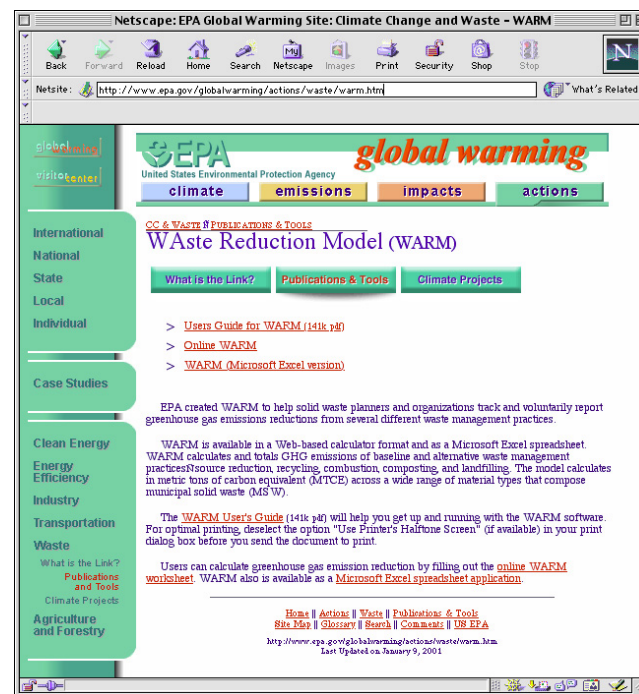




Research and Technical Assistance **Waste Reduction Model (WARM)**

- Tool to assess GHG impacts of waste reduction activities
- Designed to accept user-specific inputs and provide individualized results
- Available online

- <http://www.epa.gov/globalwarming/actions/waste/warm.htm>





Research and Technical Assistance

Domestic Stakeholder Assistance

■ State and Local Action Plans

- Delaware
- Iowa
- Minnesota
- Montana
- New Jersey
- International Council for Local Environmental Initiatives (ICLEI) - Cities for Climate Protection



Research and Technical Assistance

Domestic Stakeholder Assistance (cont.)

■ Technical Analyses

- Integrated Waste Services Association
- U.S. Department of Energy's 1605b Program
- New Jersey Department of Environmental Protection
- ICLEI Cities for Climate Protection



Research and Technical Assistance

Domestic Stakeholder Assistance (cont.)

■ Outreach Support

- Air and Waste Management Association
- American Forest and Paper Association
- American Plastics Council
- National Recycling Council
- Michigan Recycling Coalition
- Solid Waste Association of North America



Research and Technical Assistance **Stakeholder Assistance (cont.)**

■ International

- China
- Canada
- Taiwan
- OECD Working Groups on Extended Producer Responsibility and Waste Minimization



Research and Technical Assistance **Looking Forward...**

- Publish revised GHG report with updated/new GHG factors (summer '01)
 - New emission factors may include green building materials and electronics (i.e., PCs, TVs)
- Conduct an analysis of costs associated with waste reduction strategies





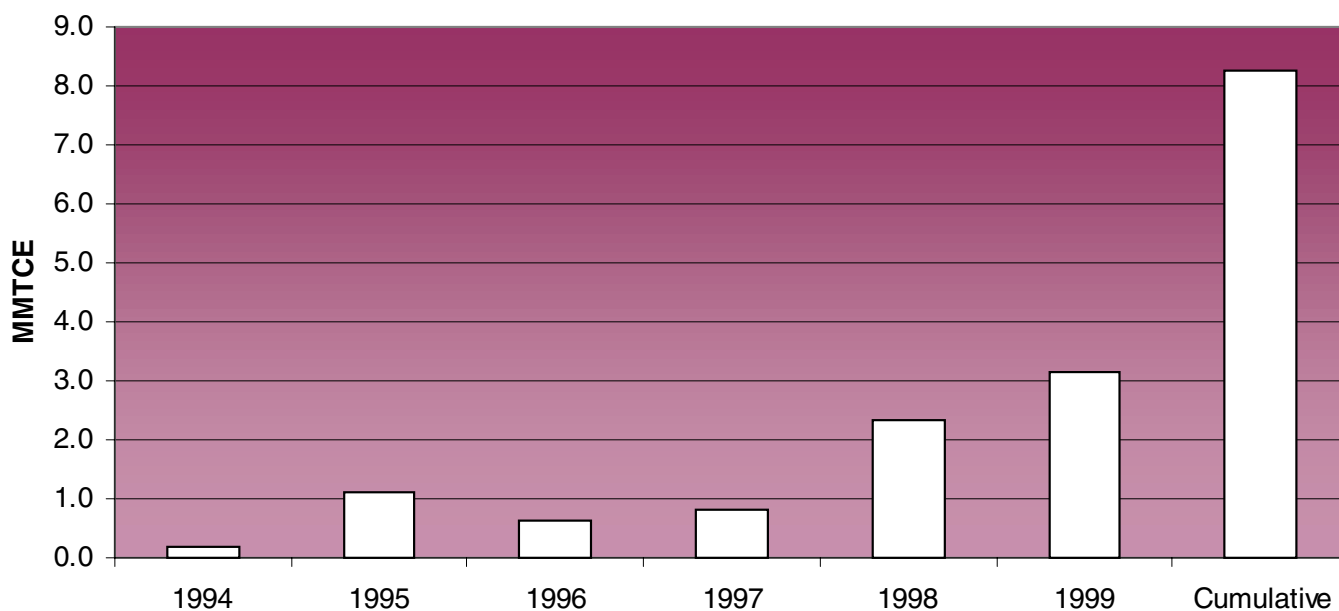
Program Implementation **Purpose**

- Meet the emission reduction goal established in the U.S. Climate Change Action Plan- 4.2 MMTCE by 2000
- Demonstrate the linkages between GHG emission reductions and waste reduction activities



Program Implementation **Climate and Waste Results**

**Program Results using Annualized Estimates
Results 1994-1999, Cumulative Reductions**





Program Implementation **Suite of Programs**

■ Established programs

- WasteWise
- Pay-As-You-Throw (PAYT)
- Demonstration Projects

■ Emerging initiatives

- Extended Product Responsibility (EPR)
- Waste-Related Biomass
- Green Buildings



Program Implementation

WasteWise

<http://www.epa.gov/epaoswer/non-hw/reduce/wstewise/index.htm>

- Encourages cost-effective actions to reduce solid waste
- Voluntary program; 1,100 partners
 - Businesses
 - Federal, state, local, and tribal governments
 - Institutions
- Partners report accomplishments annually
- Quantifiable results



Program Implementation

Pay-As-You-Throw (PAYT)

<http://www.epa.gov/payt/>

- Provide economic incentive for residential waste reduction
 - >5,000 communities
 - ~0.088 MTCE emission reduction per person
- EPA distributes information, provides training and technical assistance



Program Implementation

Demonstration Projects

<http://www.epa.gov/globalwarming/actions/waste/project.html>

- >35 solid waste climate change grant projects awarded to state and local governments and NGOs
- EPA tracks results and measures emission reductions



Program Implementation

Extended Product Responsibility

<http://www.epa.gov/epr/>

- Increase reuse and recycling of problem wastes through agreements
- EPA encourages product stewardship in government and industry
- Programs underway for carpeting and electronics



Program Implementation **Biomass**

- Promote diversion of organic wastes from landfills
- Goals of biomass projects underway
 - Develop a product standard for compost
 - Analyze carbon sequestration in soil
 - Develop a compendium of wood recycling projects
 - Utilize compost in landscaping and building construction



Program Implementation **Green Buildings**

- Reduce waste generation and GHG emissions by promoting “green” building practices
- Preliminary analysis underway to identify top materials management and waste reduction practices for green building



Outreach and Education **Purpose**

- Educate and inform stakeholders about linkages between climate change and solid waste
- Provide information and tools to stakeholders
- Publicize magnitude of emission reductions achievable through integrated waste management



Outreach and Education

Materials Developed

- Website
- *Reusable News* edition on Climate Change and Waste
- Fact sheets
- Brochures
- Reports (e.g., MSW GHG Report)
- Tools (e.g., WASTE Reduction Model - WARM)



Outreach and Education

Looking Forward...

- Emerging technology fact sheets
- Success stories
- Articles for trade publications
- Revised report



Summary

- There is a strong link between waste reduction and climate protection -- best estimated using life-cycle approach and IPCC methods
- Waste reduction can be a low-cost strategy that broadens national, state, and local GHG mitigation portfolios



Summary (cont.)

- States and local governments can make a difference
 - Develop a GHG action plan that includes waste reduction strategies
 - Collect data that will allow you to quantify and publicize the benefits of waste reduction using WARM or another GHG emission estimation tool
 - Communicate the linkages between waste reduction and GHG emissions to the public



Summary (cont.)

- Waste managers can make a difference
 - Use WARM to evaluate the GHG impacts of various waste management strategies
 - Include GHG impacts of waste management practices in your decisionmaking process
 - Allocate funds to recycle materials that result in the greatest GHG benefit
 - Consider establishing a centralized composting facility
 - Consider adopting PAYT in your community
 - Communicate the linkages between waste reduction and GHG emissions to the public



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